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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/722,839	11/25/2003	Nicolas Bright	LAM2P318D	8198

25920 7590 12/22/2004

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EXAMINER	
NGUYEN, GEORGE BINH MINH	
ART UNIT	**PAPER NUMBER**
3723	

DATE MAILED: 12/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/722,839	BRIGHT ET AL.	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14 and 15* is/are allowed.

6)☒ Claim(s) *1-5 and 7-14* is/are rejected.

7)☒ Claim(s) *6* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 November 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *112503*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Receipt is acknowledged of the IDS filed on November 25, 2003 which has been considered and placed of record in the file.

Claims 1-15 are presented for examination.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Monroe'6,227,939 in view of Hwang et al.'6,234,374.

With reference to Figures 3 and 4, col. 3, line 23 to col. 4, line 19, Monroe discloses an apparatus for regulating carrier and carrier plate temperature, and thereby regulating the temperature of an attached wafer. The wafer temperature is important in achieving uniform polishing.

Fig. 3

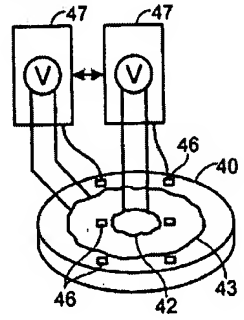
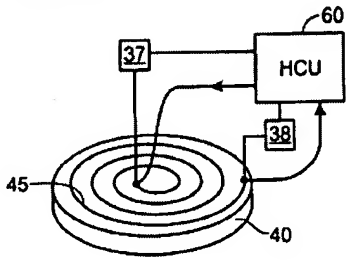


Fig. 4



Referring to FIG. 3, a perspective view of one embodiment of a carrier plate 40 for use in a wafer carrier 20 in accordance with the present invention is shown. Carrier plate 40 includes temperature control mechanisms to achieve a more uniform temperature across the entire surface of the carrier plate. In the embodiment of FIG. 3, carrier plate 40 includes two piezo electric coils 42,43 which provide central and outer region heat sources or heat sinks, depending on the direction of current flow. Temperature sensors 46 provide temperature feedback through temperature control circuit 47. Control circuit 47 provides current in a first direction to cause a coil to function as a heat source and in an opposite direction to cause a coil to function as a heat sink, as is known. While two coils are shown in FIG. 3, it should be understood that additional coils (and more temperature sensors) could be provided for more precise temperature control.

Coils 42,43 can be formed with carrier plate 40 in a plurality of manners. These include but are not limited to surface mounting, creating channels in the carrier plate and providing the coils in the channels and casting the carrier plate about the coils, etc.

While coils 42,43 are preferably piezo-electric coils, it should be recognized that the coils could be electric coils that serve only as heat sources. Through feedback mechanisms, these coils can provide uniform, albeit elevated, wafer temperature.

Referring to FIG. 4, a perspective view of an alternative embodiment of a carrier plate for use in a wafer carrier in accordance with the present invention is shown. Carrier plate 40 of FIG. 4 has a channel 45 formed therein that spirals out from the center to the periphery of the plate. Heat conducting fluid is circulated through this channel from a heater-chiller unit (HCU) 60. Thermo couple devices 37,38 are preferably connected between the HCU and the center and periphery, respectively, of the carrier plate. The thermo couples provide temperature sensing as is known. HCU 60 along with sensors 37,38 provides appropriate feedback and temperature adjustment.

Carrier plate 40 of FIG. 4 may be made by machining a groove in the surface of a reduced thickness carrier plate component and covering this component with a properly aligned cover disk. The carrier plate component and cover disk are then joined (by adhesive or edge coupling or the like) in such a manner to form a non-leaking, not obstructed channel 45.

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Referring again to FIG. 2, a cut-away side view of a three wafer carrier 20 in accordance with the present invention is shown. Wafer carriers 20 preferably include an insulation film 50 that is configured to provide better thermal insulation than prior art films which served only to smooth out bumps and other surface defects on the exterior surface of the carrier plate. By providing good insulation, the effects of carrier plate 40 as a heat sink are substantially reduced or eliminated. By reducing or eliminating carrier plate 40 as a heat sink, the surface temperature of the wafer is more uniformly distributed which results in a more uniform polish.

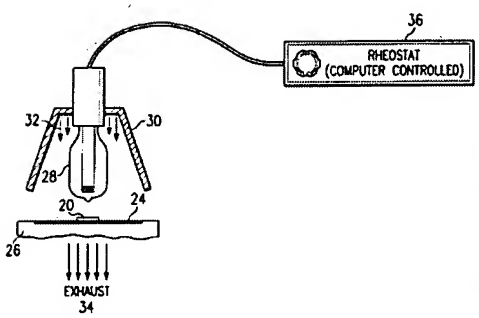
Film 50 preferably has an R value greater than 1 and more preferably an R value several times greater than 1. film 50 may be formed of polyethylene or polystyrene or any other suitable material. In one preferred embodiment, film 50 is made of polystyrene having a thickness of 3 mm and an approximate R value of 12.

It should be recognized that the present invention includes a temperature regulated carrier without a substantially insulating film, a non-temperature regulated carrier with a substantially insulating film, and a temperature regulated carrier with a substantially insulating film. It should further be recognized that while temperature regulation of the carrier plate is preferred (due to its proximity to the wafer), temperature regulation of other parts of the carrier, e.g., the secondary housing or gimbal, etc., to achieve temperature regulation of a mounted wafer is also within the present invention.

However, Monroe does not disclose a halogen tungsten light source as energy transfer to direct high intensity light energy onto the entire area of the wafer.

With reference to the only Figure, col. 3, lines 25-65, Hwang et al.'374 teaches that it is known to have utilized a tungsten halogen lamp to direct heat to a structure to permit a predetermined function to be performed. The advantage is to provide a smooth heat

transfer transient. And rapid optical heating allows rapid thermal response (col. 3, lines 50-60).



The FIGURE is a drawing conceptually illustrating an inventive optical heating system and method for use in conjunction with bonding of a wire between a pad on a semiconductor chip and a lead frame. In the FIGURE, a silicon semiconductor die **20** rests on a chip pad **26** along with a lead frame **24**. Examples of lead frame materials include copper, alloy 42, palladium/copper, and nickel copper. An optical heat source **28**, a typical such source being described in the above noted application, can be used herein and that heat source is incorporated herein by reference. Optical heat source **28** generates substantial radiations in the 0.5 to 2 micron range, this energy being used to heat the lead frame **24** and the die **20**. For copper based lead frames and normal die size, this heating system is particularly advantageous as the lead frame **24** remains much cooler than die **20** during die heating. As an example, a 1 minute exposure to optical heat source **28** may result in die **20** being heated to about 200° C. while lead frame **24** is heated to only about 125° C. As such, optical heat source **28** selectively heats die **20**. Principal heat transfer occurs by radiation and the temperature response of the die is advantageously a smooth transient. Temperature profiles can be readily controlled during cure by varying the current through the lamp **28**. In the prior art heater block method, however, heat transfer is through conduction which results in a step function like temperature response. Resident heat in the heater block precludes rapid cooling, thereby causing further oxidation of the lead frame material. Rapid optical heating allows rapid thermal response.

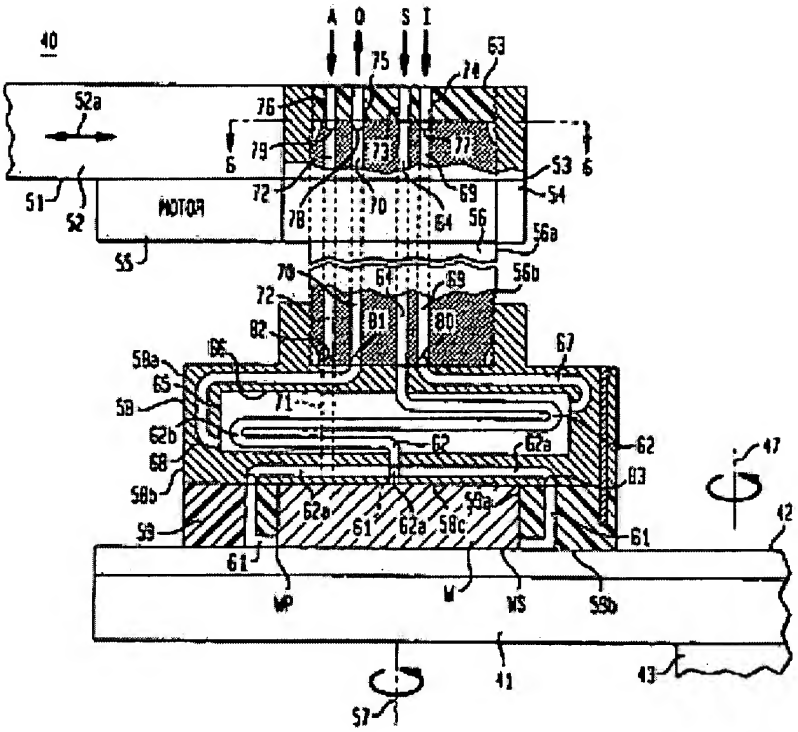
Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have substituted the heat transfer of electric coils in Monroe with the teaching of utilizing halogen tungsten lamp as taught by Hwang in order to provide a rapid optical heating which allows rapid thermal response.

3. Claims 3-5, 7-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Monroe and Hwang as applied to claim 1 above, and further in view of Pandey et al.'6,264,789.

Monroe as modified by Hwang has been discussed above, but does not disclose a passageway through the wafer carrier to supply slurry to the wafer and a heat transfer

unit to control the slurry temperature to the desired temperature before being supplied to the wafer.

With reference to Figure 5, col. 10, line 41 to col. 11, line 43, Pandy et al.'789 discloses a system for dispensing polishing liquid during chemical mechanical polishing of a semiconductor wafer. A CMP slurry is dispensed to the wafer periphery in the vicinity of the pad at a plurality of perimetrically spaced apart channels in the wear surface maintained in fixed relation to the wafer during the relative movement. Passages in the spindle flow connected with conduits in the carrier correspondingly supply the slurry to the ring channels, temperature adjusting fluid to and from the heat exchanger, and pressure fluid, air, to the inner side of the wafer in the ring aperture, respectively, during rotation and oscillation of the wafer, ring, carrier, and spindle. Please note that the phrase "temperature adjusting fluid" inherently teaches a feedback control loop with a temperature detecting means to control the fluid temperature to maintain the slurry at a desired temperature.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58b
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58c
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59b
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For this purpose, carrier **58** is provided with a slurry conduit **62** extending, e.g., centrally axially along spindle axis **57**, from its upper portion **58***a* to its lower portion **58***b* and which downwardly terminates in a plurality of, e.g., four, slurry sub-conduits **62***a*. The plurality of slurry sub-conduits **62***a* generally radially outwardly extend from slurry conduit **62** to underside portion **58***c* for corresponding flow communication with the like plurality of channels **61** in ring **59** at wear surface **59***b*.

Referring now more specifically to FIG. **5**, it is seen that apparatus **40** additionally includes slurry conduit coils **62***b*, a slurry passage **64**, a heat exchanger **65**, a chamber **66**, an inflow conduit **67**, an outflow conduit **68**, an inflow passage **69**, an outflow passage **70**, an air conduit **71**, an air passage **72**, a slurry bore **73**, an inflow bore **74**, an outflow bore **75**, an air bore **76**, and the grooves **77**, **78**, **79**, **80**, **81**, **82** and **83**.

Spindle **56** is provided with slurry passage **64** which extends, e.g., centrally axially along spindle axis **57**, like slurry conduit **62** of carrier **58**, from its top end **56***a* to its bottom end **56***b* and is arranged for alignment and flow communication with slurry conduit **62** of carrier **58**. Cap **63** of bearing unit **53** is desirably axially adjustably attached, e.g., by screw threads, to the top portion of bearing unit **53** to make constant sliding seal contact with the top end **56***a* of rotating spindle **56** in conventional manner. Cap **63** is provided with slurry bore **73** which is positioned, e.g., centrally axially, and arranged for alignment and flow communication with slurry passage **64** of spindle **56**.

Thus, although spindle **56** rotates with respect to non-rotating cap **63**, slurry S may be fed from a non-rotatable supply (not shown) at a predetermined flow rate through slurry bore **73** of cap **63**, slurry passage **64** of spindle **56**, slurry conduit **62** and slurry sub-conduits **62***a* of carrier **58** to slurry channels **61** of ring **59**, in any position of rotational movement of spindle **56** relative to bearing unit **53**, and cap **63**, for uniform dispensing to the immediately adjacent portions of wafer surface WS at wafer surface periphery WP for efficient CMP of wafer surface WS.

Desirably, carrier **58** also includes heat exchanger **65**, e.g., formed as a chamber **66**, with inflow conduit **67** extending from its upper portion **58***a* to chamber **66**, outflow conduit **68** extending from chamber **66** to its upper portion **58***a* and slurry conduit **62** passing through chamber **66**, e.g., in the form of one or more slurry conduit coils **62***b* of heat transfer material such as metal tubing, in indirect heat exchange relation to chamber **66** and inflow conduit **67** and outflow conduit **68**.

In turn, spindle **56** has inflow passage **69** and outflow passage **70**, each extending from its top end **56***a* to its bottom end **56***b* and arranged for corresponding flow communication with inflow conduit **67** and outflow conduit **68**, respectively, of carrier **58**. Cap **63** of bearing unit **53** has inflow bore **74** and outflow bore **75** arranged for corresponding flow communication with inflow passage **69** and outflow passage **70**, respectively, of spindle **56**.

Thus, although spindle **56** rotates with respect to non-rotating cap **63**, temperature adjusting fluid, e.g., heated or cooled liquid, is fed as inflow I from a non-rotating circulating supply (not shown), e.g., at a predetermined flow rate and temperature, through inflow bore **74** of cap **63**, inflow passage **69** of spindle **56** and inflow conduit **67** of carrier **58** to chamber **66** for indirect heat exchange with slurry S in slurry conduit **62**, e.g., via heat transfer slurry conduit coils **62***a*. The temperature adjusting fluid is then returned from chamber **66** as outflow O via outlet conduit **68** of carrier **58**, outflow passage **70** of spindle **56** and outflow bore **75** of cap **63** to the non-rotating circulating supply (not shown) for reheating or recooling, as the case may be, before being fed again to inflow bore **74**.

This circulating flow of temperature adjusting fluid is thus fed as inflow I via inflow bore **74** to chamber **66** of heat exchanger **65** and returned as outflow O via outflow bore **75** therefrom in any position of rotational movement of spindle **56** relative to bearing unit **53**, and cap **63**, for uniform heat exchange temperature adjustment of slurry S just before it is dispensed via channels **61** of ring **59** for efficient CMP of wafer surface WS.

Conveniently, the circulating inflow I and outflow O of the temperature adjusting fluid is preheated or precooled external to carrier **58** yet within the confines of apparatus **40**, such as in the vicinity of support beam **52** by suitable means such as a heating or cooling element (not shown) in conventional manner.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the apparatus of Monroe as modified by Hwang with a slurry dispensing system as taught by Pandey in order to provide CMP operations on a wafer under reproducible uniform conditions of polishing liquid temperature and supplying of polishing liquid locally to all portions of the wafer

regardless of its relative position of movement with respect to the platen polishing pad, and also under reproducible uniform conditions of selective temperature adjustment of the polishing liquid in the vicinity of the wafer because close control of slurry temperature are necessary to attain in a reproducible manner a uniform removal rate per the CMP operation (col. 1, lines 45-50).

Allowable Subject Matter

4. Claims 14-15 are allowed.

5. Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following is a statement of reasons for the indication of allowable subject matter: the specific limitations of "a wafer mounting film mounted ... thermal conductivity" in claim 6 and in the combination as claimed in claim 14 are not anticipated nor made obvious by the prior art of record in the examiner's opinion. Please note that Saka et al.'6,458,013 discloses a method of chemical mechanical polishing wherein in col. 9, lines 45-59, the method discloses an equation having C2 depending upon the interfacial friction coefficient and the thermal conductivities of the backing film and the pad, and the cooling system of the head and platen. However, Saka fails to provide or suggest the specific limitations of "a wafer mounting film mounted ... thermal conductivity" in claim 6 and in the combination as claimed in claim 14.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Moore'5,954,912 discloses a rotary coupling for dispensing slurry through a passage in a wafer carrier.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 703-308-0163. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 703-308-2687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE NGUYEN
PRIMARY EXAMINER

George Nguyen
Primary Examiner
Art Unit 3723

GN – December 17, 2004